

THE CHARACTERISTICS OF THE DACTYLOPTEROIDEA.

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(With Plate XIX.)

The Dactylopterids, or mail-cheeked fishes known as the flying gurnards, or, more vaguely, flying-fishes, so celebrated among navigators, and of which we have so many accounts in their writings, have been generally placed in the family Triglidae or with related forms by others associated with those fishes. They differ, however, much more than do the *Triglidae* and *Peristedidae* among themselves. In the words of Cuvier and Valenciennes, "it is even with difficulty that we are able to find any other character common to all of them than the extent of the casque which protects their head, but even this casque has an entirely different form, it is long and wide, but at the same time flat and little elevated. The snout is short and destitute of prominences. The enlarged suborbital does not cover the entire cheek and articulates in a movable manner with the preoperculum, so that the latter can spread out more than in the *Triglidae*, and thus the fish can avail itself in its defense of the enormous spine which arms the inferior angle of the bone. The operculum, on the contrary, is not spinous. The teeth of the Dactylopterids are small and paved, and they exist only on the jaws and not on the vomer or palatines. Their branchial apertures are but little open, and there are only six rays in their membrane.* They have only four

* The exact words of Cuvier and Valenciennes (v. 4, pp. 114, etc.) are as follows:

"Ces poissons, si célèbres parmi les navigateurs, et dont tant de relations font l'histoire, ont été généralement placés dans le genre des trigles; mais ils en diffèrent beaucoup plus que les trois sous-genres dont nous venons de parler ne diffèrent entre eux: c'est même à peine si l'on pourrait leur trouver d'autre caractère commun que l'étendue du casque qui garantit leur tête; encore ce casque a-t-il une tout autre forme: il est long et large, mais plat et peu élevé. Le museau est court et sans prominences. Le sous-orbitaire ne couvre pas toute la joue et s'articule d'une manière mobile avec le préopercule; en sorte que celui-ci peut s'écarter plus que dans les trigles, et que le poisson peut profiter pour sa défense d'une énorme épine qui arme l'angle inférieur de cet os. L'opercule, au contraire, n'est pas épineux. Les dents des dactyloptères sont en petits pavés, et ils n'en ont qu'aux mâchoires seulement, et non au vomer ni aux palatins. Leur ouïes s'ouvrent peu, et il n'y a que six rayons dans leur membrane. Il n'y en a que quatre dans les ventrales; circonstance très-rare parmi les acanthoptérygiens. Les pectorales n'ont point de rayons libres; mais elles

soft rays in the ventrals, a characteristic very rare among the acanthopterygians. The pectorals have no free rays, but they are deeply divided into two parts, an anterior of moderate length and with few rays, and a posterior almost as long as the body and whose rays are doubled, so that they are carried to the number of nearly thirty. When this part spreads out, it becomes as wide as long, and it is by means of the extensive surface it presents that the fish can raise itself into the air and sustain itself therein for some moments.* Such are essentially the words of Cuvier and Valenciennes respecting the Dactylopterids, published sixty years ago. Instead of improving upon this knowledge and obtaining truer conceptions of the forms in question, subsequent naturalists have fallen back, and it would appear from the comparatively recent literature that the Dactylopterids were considered to be very closely related to the Triglids and the Peristediids. Indeed, they had been universally associated with one or both of those types in the same family until 1885. In that year I separated them as a distinct family, being convinced that the characters which appeared on the surface must be the expressions of fundamental structural peculiarities. I was not prepared, however, to find the differences between the Dactylopterids and the fishes with which they had been associated so great as they appeared on a critical examination of the osteology. The words of Cuvier and Valenciennes were thus found to be applicable with even greater force than they had anticipated. The Dactylopterids not only represent a peculiar family, but, so different from all others are they, they must be regarded as representatives of a distinct superfamily having a number of remarkable peculiarities. This superfamily may be defined as follows:

DACTYLOPTEROIDEA.

Craniomous fishes with the posttemporals suturally connected with the posterior bones of the cranium and with the upper surface forming a large portion of the roof of the cranium; infraorbital chain well developed but leaving a wide interval between the posterior bones and the preoperculum; the anterior or preorbital bone elongated and extending backwards to and uniting with the fourth; the second and third bones shoved out of the orbital margin by the junction of the first and fourth; the second depressed below the fourth, and the third much reduced and manifested as a special bone (pontinal) bridging the interval between the second suborbital and the antero-inferior angle of the preoperculum; intermaxillines with well-developed ascending pedicles

se divisent profondément en deux parties, une antérieure, de longueur médiocre et de peu de rayons, et une postérieure, presque aussi longue que le corps, et dont les rayons se dédoublent; ce qui en porte le nombre à près de trente. Lorsque cette partie s'étend, elle devient aussi large que longue, et c'est au moyen de la grande surface qu'elle présente que le poisson peut s'élever dans l'air et s'y soutenir quelques instans."

* See p. 3 a.

gliding into the cavity between the anteor (vomere) and proethmoid; pharyngeals partially developed, the hypopharyngeals broadly triangular and separate; the epipharyngeals well developed on each side; myodome undeveloped, the cranial cavity mostly closed in front by extension from the subteclals (orbitosphenoids) and from the prootics and parasphenoid which are suturally connected with each other; the proethmoid and anteor entirely disconnected, leaving a capacious rostral chamber opening backward mesially in the interorbital region; vertebræ much compressed, with special spiniform processes extending from the dorso-lateral and ventro-lateral surfaces of the centra; ribs directly articulated with the centra; scapular arch abnormally developed; proscapula with lateral expansions extending inwards; hypercoracoid small; hypocoracoid enlarged, uniting by large surface with the hypercoracoid and proscapula, and with a long process extending down towards the symphysis, leaving a wide interval between it and the proscapula; actinosts graduated and mostly connected with the hypercoracoid.

DACTYLOPTERIDÆ.

Synonyms as family names.

- < *Dactipli Rafinesque*, *Indice d' Ittiol. Siciliana*, p. 23, 1810.
 = *Dactylopteridæ* or *Cephalacanthidæ Gill*, *Standard Nat. Hist.*, v. 4. p. 252, 1885.
 = *Cephalacanthidæ Jordan*, *Man. Vert. North. U. S.*, 5 ed., p. 151, 1888.
 < *Dactylopteridæ Lydekker*, *Man. Pal.*, by Nicholson and Lydekker, v. 2, p. 1006, 1889.
 = *Dactylopteridæ Cope*, *Am. Nat.*, v. 23, p. 861 (name only), 1890
Trigloidei gen. *Bleeker*.
Triglidæ s. f. *Kaup et al.*
Cataphracti gen. *Günther et al.*

Synonyms as subfamily names.

- = *Dactylopterinæ Gill*, *Cat. Fishes, E. Coast N. Am.*, p. 43, 1861.
 = *Dactylopterinæ Kaup*, *Archiv. f. Naturg.*, 1873, I, pp. 79, 84.
 > *Cephalacanthinæ Kaup*, *Archiv. f. Naturg.*, 1873, I, pp. 79, 84.
 = *Dactylopterinæ Jordan & Gilbert*, *Syn. Fishes N. Am.*, p. 732, 1882.

Description.

Body elongated and antrorsiform or slightly subfusiform, widening towards the head.

Anus submedian.

Scales hard, crenulated at their margins and enlarged at each of the angles of the base; those of the back and sides surmounted each by a longitudinal finely crenulated crest, the crests being very regularly disposed and so joined as to form trenchant ridges which extend in a straight line the length of the fish, and of which the median lateral extend as far as the caudal. (C. V.).

Head parallelopiped, oblong, incased with a bony casque, whose upper surface is derived partly from a dermal ossification which is incongruous

with the true bones; with the posterior lateral limbs of the casque, composed of the post-temporal and the connecting bones, projecting backwards in spiniform extensions on each side of the first dorsal fin.

Eyes mostly in the anterior half of the head, entirely lateral, and widely separated from each other.

Nostrils double, the two openings separated by a narrow bridge and inclosed in a common cavity in the casque above the preorbitals.

Suborbitals peculiarly developed, and with a free peripheral margin except at the pontinal; the preorbital very long, extending forwards and articulated with or nearly meeting its fellow of the opposite side, articulating behind with two bones, one above its angle (the fourth suborbital) forming most of the margin and floor of the orbit, the other (the second suborbital) inferior entering into the lower margin of the head; the latter articulates with a small special bone (the third suborbital or pontinal) which articulates with the inner angle of the preoperculum. Behind the orbit is a small, rather narrow postorbital connected with the sphenotic.

Opercular apparatus peculiar; the *operculum* small, flexible, subcircular or subtriangular, and covered with scales; *suboperculum* almost membranous, mostly concealed, and partly behind and below the operculum; *interoperculum* reduced to a small bone connected by ligament with the lower jaw, and remote from the interoperculum, mostly folded under the anterior margin of the preoperculum.*

Preoperculum enormously developed, dividing into two long narrow branches, a subvertical and a horizontal, and terminating behind in an elongated spine continued from its horizontal and underlying the pectoral fin.

Mouth small, opening directly under the snout, and with its cleft nearly parabolic.

Jaws normally developed; the intermaxillines with moderately elongated pedicles, compressed and converging behind, and with a broad dentigerous surface in front; the supramaxillines forming the lateral borders of the mouth, with the sellæ convex on the anterior surface and fitting into the concave surface of the intermaxillines, and with the posterior limbs but moderately expanded.

Teeth pisiform or obtuse and in bands on the jaws, but none on the palate.

Lips slightly fleshy.

Tongue small, reduced to a smooth, narrow, fleshy convexity of the floor of the mouth.

*Cuvier and Valenciennes wrongly describe the suboperculum and interoperculum as disappearing almost at the membrane. Their words are, "le sous-opercule et l'interopercule disparaissent presque dans la membrane" (p. 123). The interoperculum, however, has its normal relations with the lower jaw, and, although small, is distinctly developed.

It was correctly determined by C. Daresse, in 1872 (*Comptes Rendus Acad. Sc.*, 1872), and by Sorensen (*Naturhist. Tijdskr.*, 1884, pp. 75-78).

Branchial apertures small, vertical, mostly in front of the anterior bases of the pectorals, and consequently separated from each other by a very wide isthmus.

Branchiostegal rays six, three perceptible in the smooth, movable portion of its membrane, the fourth quite straight, enveloped in the part of the skin by which the membrane unites with the throat, and the two others concealed by the skin of the throat and by the scales with which it is furnished. (C. V.)

Dorsal fins two, the anterior with six or eight heteracanth spines, the foremost two of which are generally more or less detached; the posterior fins with only eight to ten rays, most of which are simply articulated and rather short; between the two fins is a compressed lancet-like spine, immovably connected with the interspinal below.

Anal fin opposite and nearly coterminous with the second dorsal, short, and with only six articulated rays.

Caudal fin emarginate, with its lobes nearly equal and with few rays, *e. g.*, seven or eight complete and two unbranched or rudimentary above and two or three below.*

Pectoral fins greatly specialized, expanding in a horizontal plane and composed of two distinct portions; an anterior or upper small, and an inferior or posterior enlarged portion, the former composed of five or six rays, the latter of numerous long and slender unbranched rays, and a number of short graduated ones forming a kind of axillar fringe; all connected by membrane which is but slightly emarginated about the middle between each pair of rays. The fins are underlaid by the very elongated spines of the preoperculum.

Ventrals thoracic, separated by a narrow interval, and composed of a spine and four unbranched rays, the innermost of which are short and slender.

Branchiæ complete and with the last arch separated by a cleft from the hypopharyngeals and œsophagus.

Branchial rakers rudimentary or absent; *pharyngobranchial* bones three on each side; the third enlarged and dentigerous (*epipharyngeal*), the other rudimentary and edentulous.

Pseudobranchiæ developed.

It will appear from this description, when compared with those of the Triglidae and the Peristediidae, thus the Dactylopteridae differ in almost all respects from those forms with which they have been associated, and in fact the only reason for ever having brought them together is the fact that both have a head furnished with a casque, or armed, but, as already indicated, this casque is extremely different in the two types. Possibly another character is that there is a good deal of red about the body, for, absurd as such a cause would be, it has evidently influenced

* The formula may be 1 (small, simple) + 1 (large, simple) + 4 (branched) + 3 (branched) + 1 (large, simple) + 2 (small, simple).

various writers in making approximations of fishes. Although Cuvier and Valenciennes had correctly described the pectorals sixty years ago, later writers have reversed the two parts and called the small anterior portion the lower, and the posterior or inferior the upper portion of the fin. Thus Dr. Günther, in the second volume of the "Catalogue of the Acanthoptergzian fishes in the British Museum" (p. 221), has described, himself italicizing the characteristics, "*Pectoral very long (organ for flying), with the lower portion detached and shorter.*" The same view has been taken by Professors Jordan and Gilbert, who have evidently followed Dr. Günther, in the "Synopsis of the fishes of North America" and in the Manual of the vertebrates of the northern United States, by Jordan. Dr. Lütken had shown the error of such a view, and Dr. Günther, in his "Introduction to the study of fishes," has corrected his former error. Looking at the fish, one can not help wondering that such an error could ever have been made, and it was probably due to some false idea of an analogy between the small portion of the fin with its few rays and the three detached rays of the Triglidae or the two of the Peristediidae. A very slight consideration of the morphology of the fin, however, would have sufficed to have prevented such a blunder.

The only recognized genus of the family is *Dactylopterus*, which has received various names.

DACTYLOPTERUS.

Synonyms.

Pungitius *Linnaeus* Mus. Ad. Fried., p. 74, 1754.

Cephalocanthus *Lacépède*, Hist. Nat. Poissons, t. 3, p. 323 (Young) 1801.

Dactylopterus *Lacépède*, Hist. Nat. Poissons, t. 3, p. 325 (Mature) 1801.

Dactylophorus *Swainson*, Nat. Hist. Fishes, etc., v. 2, pp. 55, 179, 262, 1839.

Gonocephalus *Gronovius* Syst. Ich., Gray ed., p. 106, 1854.

Cephalacanthus has been adopted in place of *Dactylopterus* by a few because it happened to be printed two pages in advance of the latter, but, while it is a much better name, the reason for adopting it is insufficient as the two names were evidently published at the same time and *Dactylopterus* has been almost universally adopted.

Dactylophorus was simply the result of a misreading or misapprehension by Swainson, and *Dactylopterus* is elsewhere used by him in the same work (v. 1, pp. 17, 27; v. 2, pp. 415-419*).

Gonocephalus is a name given in a manuscript finished by Gronovius about 1780, but unpublished till 1854.

The only figures illustrative of the osteology of *Dactylopterus* I have seen are the following:

DACTYLOPTERUS VOLITANS.

Dactylopterus volitans *Sorensen*, Lydorganer hos Fiske (Naturhist. Tijdskr., 1884), pp. 75-78, pl. 3, fig. 37-42, 1884.

* Seven new specific names are given by Swainson to what are, in most cases at least, formerly described species, owing to various misapprehensions.